

PATENT CLAIMS

1. Electro-mechanical drive device for adjustment devices of a motor vehicle, more particularly for a window lifter, which has

- a gearing with a gear housing (A2, A2', B2, C2, D2, D2', D2")
- an electric motor (A1, C1, D1, D1") mechanically connected to the gearing
- a control device (A5, A5', B5, C5, D5', D5", E5) mounted in the gearing housing (A2, A2', B2, C2, D2, D2', D2") and having at least one power semi-conductor for controlling the electric motor (A1, C1, D1, D1") and
- means (A9, A9', B9, C9, D9, D9', D9", E9) thermally coupled to the power semi-conductor as heat sink for drawing off waste heat from the power semi-conductor,

wherein the means (A9, A9', B9, C9, D9, D9', D9", E9) are integrated in the gear housing (A2, A2', B2, C2, D2, D2', D2").

2. Electro-mechanical drive device according to claim 1,

characterised in that

for the purpose of coupling, the means ((A9, A9', B9, C9, D9, D9', D9", E9) and a power semi-conductor housing (A5, A5', B5, C5, D5", E5) are fixed with force-locking engagement against one another in order to reduce a heat transfer resistance.

3. Electro-mechanical drive device according to claim 2,

characterised in that

for the force-locking connection the means (A9, A9', B9, C9, D9, D9', D9", E9) are spring-tensioned through a spring element against the power semi-conductor housing (A5, A5', B5, C5, D5", E5).

4. Electro-mechanical drive device according to one of the preceding claims,

characterised in that

a heat conducting means is mounted for thermal coupling between the means (A9, A9', B9, C9, D9, D9', D9", E9) and a power semi-conductor housing (A5, A5', B5, C5, D5', D5", E5).

5. Electro-mechanical drive device according to one of the preceding claims,
characterised in that

the gear housing (A2, A2', B2, C2) has an opening for inserting the means (A9, A9', B9, C9) and guide elements for positioning the means (A9, A9', B9, C9) in an end position, and
 5 that the inserted means (A9, A9', B9, C9) is in particular lockable in the end position.

6. Electro-mechanical drive device according to one of claims 1 to 4,
characterised in that

10 the means (C9, D9, D9', D9'', E9) are injection moulded at least in part in an injection moulded plastics housing (C2, D2, D2', D2'') of the gearing.

7. Electro-mechanical drive device according to one of the preceding claims,
characterised in that

15 the means (C9, D9, D9', E9) are hermetically sealed in the gear housing (C2, D2, D2') against fluids and dust particles, and
 that the means (C9, D9, D9', E9) are positioned against a wall (C92, D92, D92') of the gear housing (C2, D2, D2') wherein the wall (C92, D92, D92') is thinner than the supporting parts of the gear housing (C2, D2, D2') in order to have a lower heat
 20 transfer resistance.

8. Electro-mechanical drive device according to one of the preceding claims,
characterised in that

the means (C9, D9, D9', D9'', E9) have as heat conductor (C9, D9, D9', D9'', E9) a
 25 further coupling with a cooling element to discharge the waste heat diverted away from the power semi-conductor to the cooling element, and
 that the cooling element is in particular a support plate on which the gear housing (C2, D2, D2', D2'') is fixed.

30 9. Electro-mechanical drive device according to claim 8,
characterised by

a mechanical connection between the heat conductor (C9, D9, D9', D9'', E9) and the gear housing (C2, D2, D2', D2'') and

by a fastening element (C90, D90, D90', D90'', E90) integrated in the heat conductor (C9, D9, D9', D9'', E9) for fixing the gear housing (C2, D2, D2', D2'') on the cooling element.

- 5 10. Electro-mechanical drive device according to one of the preceding claims, **characterised in that**
a bearing (E9115) for a gear element (E115) of the gearing is integrated in the means (E9).

- 10 11. Electro-mechanical drive device according to claim 10, **characterised in that**
the means (E9) have positioning elements for positioning the control device (E2) relative to the gear element (E115) or to a magnet (E155) fixed on the gear element (E115).

- 15 12. Electro-mechanical drive device according to one of claims 1 to 4, **characterised in that**
an opening (A25) of the gear housing (A2, A2', B2) is closed by a cooling lid (A9, A9', B9) as means (A9, A9', B9) and
20 that the cooling lid (A9, A9') has in particular cooling ribs.

13. Electro-mechanical drive device according to claim 12, **characterised in that**
the opening (A25) is sealed by a material connection, more particularly through
25 - ultra sound welding of the cooling lid (A9, A9', B9) to an edge of the opening (A25) or
- sticking of the cooling lid (A9, A9', B9) to an edge of the opening (A25) through an adhesive
between the cooling lid (A9, A9', B9) and an edge of the opening (A25).

- 30 14. Electro-mechanical drive device according to one of the preceding claims, **characterised in that**
conductor panels which are insulated from each other are arranged on the means (A9, A9', B9, C9, D9, D9', D9'', E9) to connect structural elements and interfaces of the
35 control device (A5, A5', B5, C5, D5', D5'', E5).

15. Electro-mechanical drive device according to claim 14,

characterised in that

the conductor panels have contact elements which can be contacted during fitting of
5 the means (A9, A9', B9, C9, D9, D9', D9'', E9)

16. Method for manufacturing an electro-mechanical drive device for adjustment devices of a motor vehicle, more particularly for a window lifter, which has in the assembled state

- 10 - a gearing in a gear housing (A2, A2', B2, D2, D2', D2'')
- an electric motor (A1, D1, D1'') mechanically connected to the gearing
- a control device (A5, A5', B5, D5', D5'', E5) with a power semi-conductor and mounted in the gear housing (A2, A2', B2, D2, D2', D2'') and controlling the electric motor (A1, D1, D1''), and
- 15 - has a means (A9, A9', B9, D9, D9', D9'', E9) integrated in the gear housing (A2, A2', B2, D2, D2', D2'', D2'') as heat sink

wherein

the power semi-conductor is thermally coupled to the means (A9, A9', B9, D9, D9', D9'', E9) as heat sink at the same time as mounting the means (A9, A9', B9, D9, D9',
20 D9'', E9) as heat sink or as fitting the control device (A5, A5', B5, D5', D5'', E5).

17. Method according to claim 16,

characterised in that

for the purpose of coupling a heat conducting means (C9, D9'', E9) is fixed as heat
25 sink with the gear housing (C2, D2'', E2) on a support plate wherein the heat conducting means (C9, D9'', E9) is pressed against the housing of the power semi-conductor of the control device (C5, D5'', E5) through the fastening.

18. Method according to claim 16,

characterised in that

the means (B9) is moved from a first mechanically stable state without thermal coupling to the power semi-conductor into a second mechanically stable state for coupling in order to thermally couple the means (B9) through contact in the second mechanically stable state with the housing (B5) of the power semi-conductor.

19. Method according to claim 16,
characterised in that

as means a cooling lid (A9, A9') is welded by ultrasound into an opening (A25) of the gear housing (A2, A2') up to contact with the housing (A9') of the power semi-conductor.

20. Use of a hermetically sealed gear housing (D2, D2', D2'') of an electro-mechanical drive device of an adjustment device for motor vehicles, more particularly for window lifters, for diverting waste heat from a power semi-conductor which is integrated in a control device (D5', D5'', E5) in the gear housing (D2, D2', D2'') wherein at least a part of the gear housing (D2, D2', D2'') is thermally coupled to the power semi-conductor to draw off the waste heat.